

AMENDMENTS TO THE CLAIMS

1. (currently amended) A battery apparatus, comprising:

plural battery modules connected in series each having plural battery cells connected in series;

plural low order control devices which are provided in correspondence with the plural battery modules, respectively, each of the plural low order control devices controlling the plural battery cells ~~configuring~~ corresponding to one of the plural battery modules, the plural low order control devices including a low order control device at a highest potential among the plural low order control devices, a low order device at a lowest potential among the plural low order control devices, and at least one low order device at a potential between the highest potential and the lowest potential among the plural low order control devices;

a high order control device which controls the plural low order control devices;

~~isolating or potential converting~~ units which ~~connects~~ connect an input terminal of the low order control device at a highest potential among the plural low order control devices to the high order control device, and an output terminal of the low order control device at a lowest potential among the plural low order control devices, ~~and to~~ the high order control device; and

interruption elements each of which is disposed between the output terminal of a corresponding one of the plural low order control devices and the battery cell in a corresponding one of the plural battery modules on a low potential side and blocks discharge current of the battery cells in the corresponding battery module, wherein

terminals related to input and output of a signal are connected in an electrically non-isolated state among the plural low order control devices, the terminals related to input and output of a signal for the at least one low order device at a potential between the highest potential and the lowest potential among the plural low order control devices being connected only to others of the plural low order control devices.

2. (original) A battery apparatus according to claim 1, wherein the input terminal of each of the plural low order control devices is electrically connected to the battery cell on a high potential side among the battery cells within the corresponding battery module being controlled by the low order control device.

3. (original) A battery apparatus according to claim 1, wherein the plural low order control devices, the isolating or potential conversion units which are disposed on the low order control devices in the highest and lowest potentials, and the high order control device are mounted on a same package, and power is supplied from outside of the package to the high order control device.

4. (currently amended) A control method of a battery apparatus which comprises:

plural battery modules connected in series each having plural battery cells connected in series;

plural low order control devices which are provided in correspondence with the plural battery modules, respectively, each of the plural low order control devices controlling the plural battery cells configuring corresponding to one of the plural battery modules, the plural low order control devices including a low order control device at a highest potential among the plural low order control devices, a low order device at a lowest potential among the plural low order control devices, and at least one low order device at a potential between the highest potential and the lowest potential among the plural low order control devices; and

a high order control device which controls the plural low order control devices, the high order control device being connected to inputs of the low order control device at a highest potential among the low order control devices, and to outputs of the low order

control device at a lowest potential among the low order control devices, inputs and outputs of the at least one low order control device at a potential between the highest and the lowest potential of the low order control devices being connected only to other low order control devices,

the control method comprising the step of:

comparing by the high order control device a signal transmitted to the low order control device at a highest potential and a signal returning from the low order control device at the lowest potential, and transmitting a next instruction when the battery apparatus is determined to be normal.

5. (original) A control method of a battery apparatus according to claim 4, further comprising the steps of:

by one of the plural low order control devices, detecting states of the plural battery cells of the corresponding battery module controlled by the one low order control device, obtaining a logical add or a logical product of a signal representing the detected states and an input signal transmitted from the low order control device at a higher potential among the plural low order control devices, and outputting a result of the logical add or product to the low order control device at a lower potential side among the plural low order control devices; and

checking abnormality of the battery apparatus by the high order control device according to the signal returning from the low order control device at the lowest potential.

6. (original) A control method of a battery apparatus according to claim 4, wherein the low order control device performs capacity adjustment to discharge remaining capacity of one of the battery cells in the corresponding battery module which voltage is

higher than a reference value, and the low order control device having completed the capacity adjustment is placed into a sleep mode.

7. (withdrawn) A battery apparatus, comprising:
 - plural battery modules connected in series each having plural battery cells connected in series;
 - plural low order control devices which are provided in correspondence with the plural battery modules, respectively, each of the plural low order control devices controlling the plural battery cells configuring corresponding one of the plural battery modules;
 - a high order control device which controls the plural low order control devices;
 - a voltage detecting unit which detects voltages of the plural battery cells within the battery module; and
 - an error calibration terminal which calibrates an error of the voltage detecting unit.

8. (withdrawn) A battery apparatus according to claim 7, wherein:
 - the voltage detecting unit is an A/D converter; and
 - the low order control device compensates an output value of the A/D converter by previously giving a digital value to the error calibration terminal of the A/D converter.

9. (withdrawn) A battery apparatus according to claim 8, wherein:
 - the A/D converter comprises:

an integration unit which integrates a unit amount of electricity according to a number of pulses;

a comparing unit which compares an integral value of the integration unit with a voltage of the battery cell and stops the pulse;

a counter unit which outputs the number of pulses when the pulse is stopped by the comparing unit; and

a compensation unit which compensates an output of the counter unit according to the digital value given to the error calibration terminal.

10. (withdrawn) A battery apparatus according to claim 9, wherein the compensation unit changes a counted value of the counter unit according to the digital value given to the error calibration terminal to compensate an offset of the A/D conversion and changes a width of the pulse to compensate a gain of the A/D conversion.

11. (new) A battery apparatus according to claim 1, wherein said interruption elements are disposed in a closed loop including the output terminal of the corresponding one of the plural low order control devices and the battery cell in the corresponding one of the plural battery modules on the low potential side.

AMENDMENTS TO THE DRAWINGS

The attached replacement sheets of drawings includes changes to Figs. 1-4, 9, and 11, as follows:

Fig. 1 – added conventional name of current detector CT;

Fig. 2 – added conventional names of drive circuits Dr1, Dr2, Dr3, and Dr4, and oscillator CZ;

Figs. 3 and 4 – added conventional names of power circuit 2 and control circuit 8;

Fig. 9 – added conventional name of compensation logic circuit 18; and

Fig. 11 – added conventional name of current sensor CT2.

Attachment: Replacement sheets